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Determination of Qibla Directions According to Islamic Astronomic Science (Case Study of Qibla Directions in Indonesia)

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This study is about the controversy surrounding the determination of the direction of Qibla in Indonesia, which so far, uses two methods. Firstly it uses the classic method based on the sunset and shadow of the sun across the Kaaba. Both Science methods are based on calculations that are equipped with astronomical formulas and data. Whereas in Fiqh studies the determination of Qibla direction generally only uses calculations without accurate data. Such differences create cross-opinions - even prolonged controversy in practically the entire Muslim world, especially Indonesia. Researchers will uncover the phenomenon by in-depth discussion of the direction of Qibla., as a form of criticism of the second Scientific method . This study attempts to measure the extent of accuracy in determining the direction of Qur'an in Indonesia by using both methods.

Key words: *Qibla Direction, Islamic Astronomy Science.*

Introduction

The study of Islamic Astronomical Science Study determines the direction of Qibla , prayer times, the Islamic calendar and the beginning of the lunar month. (Susiknan Azhari: 2001), This knowledge is an inseparable part of the lives of Muslims. The present study reveals the problem of determining the direction of Qibla in Indonesia, which often results in differences between houses of worship in all regions which leads to disputes amongst Muslims, resulting in a breakdown of community harmony, which refers not only to disputes but the remeasurement of mosque buildings, even differences in places of prayers. (Usman: 2016).

This study conducts an in-depth analysis regarding whether the change in the direction of Qibla which became controversial was due to measurement errors or an earthquake.

Therefore, determining the correct direction of Qibla is very important because Indonesia is far from apart from the City of Mecca al-Mukarramah. The Ka'bah, which is the centre of the world's Muslim Ummah, is located in the Masjid al-Haram of Mecca, facing it is one of the legal requirements for prayer. People who are in the Masjid al-Haram as well as those who are outside the city of Mecca are required to face the Kaaba. The astronomy azimuthal position can be known by the reckoning method and field measurements. The calculation of the direction of Qibla direction can be conducted by various methods ranging from traditional to modern using astronomical data. There are several studies that have been carried out relating to Falak Science including: (Mulyana, et.al: 2012, Armienti, et.al: 2017, Ghouchani, et.al: 2017, Tharabieh, et.al: 2017) and others, but they do not explain the science of Islamic astronomy.

Theoretical Foundation

Before discussing the material and the method of determining the direction of Qibla , the understanding of astronomy is stated in advance . (Ahmad Izzuddin: tt) The etymology celestial derives from orbit, the path of celestial bodies, the circulation of stars, (Luis Ma'luf: 1986) or the path of celestial bodies (A. Jamil: 2009). The word celestial originates from Arabic which has a similar meaning to the word madar nujum, (Ahmad Warson Munawwir: 1984) or orbit in English. Etymologically it can be stated that astronomical studies refer to the study of the trajectory and motion of celestial bodies such as the sun, moon and stars in their respective orbits.

Astronomy is the study of the trajectories of celestial bodies, such as the sun, moon and stars and other celestial bodies, with the aim of knowing their position (Susiknan Azhari: 1994). Thus, astronomy is "the study of the trajectory and circulation of celestial bodies such as the sun, moon, stars and other celestial bodies, knowing their position with the aim of practical interest in the implementation of worship that relates to time and place." The sphere of knowledge is broad but the discussion of prayer times, the determination of the beginning of the lunar month and determining the direction of the Qibla is called shari'a, because it is related to the implementation of religious rituals.

The word Qibla comes from the Arabic qabala-yaqbalu-qiblatah, meaning direction or facing. The word qiblat is mentioned several times in the Wuran, (Q. S: Al-Baqarah: 142, 143, 144 and Surah Yunus: 87). Facing the Qibla is the most important part of Islamic sharia, especially sharia prayer and tawaf.

The jurists agree that facing the Qibla is a valid requirement of prayer, (Wahbah Az-Zuhaily: 2008) and the law is to face Qibla when prayer is obligatory, except in emergencies such as in the case of seriously ill people, praying on a vehicle, provided that when takbiratul ihram faces towards Qibla. Among the Syafi'i schools, people who live near al-Haram mosque, both in the hills and in the lowlands, must face ain ka'bah, because they can clearly see the al-Haram mosque . So, those who look at the Ka'bah face their faith with confidence, and those far from the Ka'bah face have the Ka'bah intentionally in their hearts with zhan. (Abdurrahman Al-Jaziri:) Facing the Ka'bah does not only required for the five daily prayers but also includes those who perform circumcision prayer, corpse prayer, prostration of thanksgiving, prostration of recitation, adhan, burying the body and prostration of shaheed . (Imam Shafi'i: 2007) According to the Shafi'i school of thought, people who live outside of Mecca, must look in the direction of Qibla by asking those who know and understand the direction of Qibla (Wahbah Az-Zuhaily: 2008).

As the prophet has explained; Baitullah is the centre of the people of the Grand Mosque. Masjid al-Haram is the centre of the inhabitants of the land of Haram (Makah), and the land of the Haram is the centre of all my people on earth, and West (H.R. al-Baihaqi from Abu Hurairah).

In verses 144, 149 and 150 of surah al-baqarah verses ,Allah does not mention the Kaaba directly as the Qibla, but only instructs him to face the al-Haram mosque in Mecca, because the word al-Haram mosque is more famous than the Kaaba, and the Kaaba is inside the al-Haram mosque. That is, the qibla of Muslims is the Ka'bah located in the al-Haram mosque of Mecca (Ibn Kathir: 1992). These differences occur in determining the direction of Qibla based on each ijtihad. They face the 'Kaul Ka'bah following the results of the Malik, Shafi'i and Hambali ijtihad, and those who hold it must face the Ka'bah to follow the Hanafi school of thought.

Research Methodology

Many methods are used to determine the direction of Qibla , this study only focuses on two methods, namely the reckoning and Fiqh methods. The reckoning method is divided into classical (traditional) and modern (scientific) methods. The classical method guided by the sunset and rusdu al-kiblah and peraaktek in the field is done by rukyah, which means seeing the position of the sun directly. The scientific method uses certain methods, formulas, supported by Mecca coordinate data and regional coordinate data to be determined in the direction of Qibla and is equipped with tools such as logarithm lists, calculators and rollers. It is called the Scientific reckoning method, as it is done by calculation.

The method developed by Fiqh is to find out direction of Qibla with ijtihad. The results of research by ijtihad scholars often occurs in different instances. Shafi'i must face 'ain ka'bah both those who see the Ka'bah and those far from Mecca, Imam Hanafi simply faces the direction of Qibla . That difference creates dynamism and Muslims can choose which ijtihad results they choose to believe. Both these methods - science and Fiqh are examined in depth, compressed and analysed so that it can be seen which method is more accurate in resolving the controversy in the direction of Qibla in Indonesia. Therefore, the method adopted in this study is seen as important as a solution to overcoming and resolving cases of Qibla in various Indonesian regions . This study also examines the background of changes in the direction of Qibla and offers a way to overcome it. It is hoped that in the future there will be no further polemic in the direction of the mosque's qibla in Indonesia.

Discussion

The issues of Qibla is a matter of direction, facing towards the Kaaba which is located in the Masjid al-Haram Makah. There are two problems that need to be explained first, the definition of Qibla, and how to face it a. The direction of the Kaaba is the centre of worship. Facing the direction of Qibla means to expose the heart, mind and all parts of the body towards the Qibla (Ka'bah) when performing prayers. According to Saadoeddin Djambek, the direction of Qibla refers to the closest distance of an area to Mecca which is measured through a large arc. (Saadoeddin Djembek: 1956). Considering the importance of facing the Qibla, Allah Almighty repeats the command to face the Masjid al-Haram (Ka'bah) three times. The command in the verse is to faces the Masjid al-Haram, but what is meant is that the Ka'bah is the centre of the world's Muslims.

The reason for the Ka'bah as the Qibla and centres of Muslim worship of Muslims is that it is explained directly by Allah SWT and His Messenger as contained in the Qur'an and the Sunnah of the Prophet. That provision contains a certain truth (al-qath'iy). Therefore, Fiqh scholars agree that people who see the Kaaba must face the Ka'bah, and those who do not see the Qibla facing the Kaaba includes Indonesian Muslims.

The direction of Qibla can be determined from any place on the surface of the earth by completing calculations and measurements. Basically, the direction of qiblais calculated to find the location of the Kaaba in Mecca, all movements of people who are praying, standing, bowing and prostration while facing towards the Kaaba can be seen from the surface of the Earth (Hajar Hasan: 2014)

Based on the coordinates of various countries , the direction of the Qibla is located in the east of Mecca, the Qibla faces the West, the direction of Qibla in the south of Mecca faces North, the direction of Qibla in the West of Mecca faces East, and the direction of Qibla in the North

of Mecca faces South. For example, Pekanbaru Riau-Indonesia Province is located at coordinates 101° 28' East longitude and 00° 30' North Latitude. (Depag RI: 1994/1995) This indicates that the city of Pekanbaru is located east of Mecca and its direction of Qibla faces West. After calculating by using the spherical triangle formula, the results determine the direction of the Qibla of Pekanbaru 66° 12' measured from the North point to the West or 23° 48' measured from the West point to the North. Azimut Qibla city of Pekanbaru is 270° + 23° 48' = 293° 43' (measured from the North, East, South, West and Qibla points) is 293° 48'. Muslims of Pekanbaru carry out prayer facing Westward skewed towards the North for 23° 48' (Hajar Hasan: 2014).

Qibla Direction According to the Perspective of Islamic Astronomy Science

There are two methods discussed in this study, firstly the reckoning method and secondly the Fiqh method. The reckoning method is divided into two groups, namely the classical method and modern method. There are two kinds of classical methods, the *first* is guided by the sunset, which means that determining the qibla direction is based on the sunset, where the sunset is in the direction of the Qibla of an area, the reason being that Indonesia is located east of Mecca in other words the Ka'bah is located in Western Indonesia. Another reason is that the Sun goes West on a daily basis, therefore, determining the Qibla direction according to the classical method is very much guided by the direction of the Sunset. Therefore, mosques in Indonesia face to the West point, because they are guided by the sunset. Determining the direction of Qibla direction based on the sunset is incorrect, because the position of the rising and setting Sun is always changing.

These changes occur in accordance with changes in the Sun's declination starting from 0° to 23° 30' North Latitude and form 0° to 23° 30' South Latitude. Changes in the times of Sunrise and Sunset daily and monthly for a one year period. Great changes in sun declination reach 47° when calculated from the North point to the South , while the Qibla point of a place (area) does not change. As the position of the sunset when constantly changing is inappropriate for use as a guide in determining the direction of Qibla.

Both are guided by the shadow of the Sun when crossing the Ka'bah. During one year, the Sun passes twice over the Kaaba. May 28 is the basitah year or May 27 for leap years, and July 16 is the basitah year or July 15 for the leap year according to a method called rusdu al-Kiblah. Qibla direction measurement based on the rushdul Qibla shadow can be conducted after the Sun culminates in Mecca. The determination of measurement time is adjusted between Mecca time and regional time. Examples of the difference in Mecca time and Indonesian time include $4^j\ 20^m\ 40^d$, meaning 12 noon in Mecca then in Indonesia at $16^j\ 20^m\ 40^d$, Indonesia's location is to the east of Mecca. The difference in the location of the longitude of Mecca 39° 50' with

Indonesia's longitude 105,0º (Saadoeddin Djembek: 1956) causes a time difference between Mecca and Indonesia.

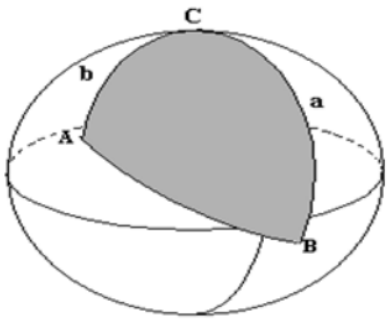
The method of Sun shade is very useful for checking the direction of Qibla, mosque, musalla, funeral and residential houses. The method is very simple by sticking a stick and then at sixteen more see the shadow of the stick, where the full distance of the stick is the direction of Qibla. Checking is done by not looking for the wrong direction of the Qibla as measured by certain methods, but by ensuring the correct direction of the mosque's Qibla.

Every point on the surface of the earth is on a globe, therefore the calculation of the direction of Qibla can be done by measuring the spherical triangle. For the sake of accuracy, calculations are performed using formulas, calculator tools, logarithmic lists, and longitude and latitude (area) coordinate data, Mecca longitude and latitude coordinates.

According to modern calculations there are three data that must be prepared in establishing the Qibla direction:

a. Latitude and longitude of the Kaba (ϕ = 21º 25' North Latitude dan λ = 39º 50' East Longitude)
b. The latitude and longitude of the area where the Qibla direction will be calculated (Abd. Salam Nawawi: 2016)
c. North Point (measurement guidelines)

Data A and C are relatively fixed , because data A is the Kaaba and data C is at the North point. While data B constantly changes depending on which place (region) the Qibla direction will be determined, for example in Pekanbaru Riau city the latitude and longitude data = 00º 30' North Latitude dan = 101º 28' East Longitude. (Depag RI: 1994/1996)
When connected with curved lines, the three data (A, B and C) forms a spherical triangle as the picture below indicates:



Point A is the position of Makah (Ka'bah), point B is the position of the city of Pekanbaru Riau and point C is the north point.

Based on the picture above, we can see the value of angle B, namely the angle flanked by side a and c. Making a triangle ball image like this is useful to help determine the value of the Qibla direction for a place (area), calculated from one point of the wind to another point, for example, calculated from the point of North to West (N-W).

Examples of determining the direction of Qibla Pekanbaru, Riau using modern reckoning methods f is known as:

a. Coordinate data of Pekanbaru and Mecca
Latitude (Ø) = 00º 30' (North Latitude)
Longitude (λ) = 101º 28' (East Longitude)
Latitude of Mecca = 21º 25' (North Latitude) (Depag RI: 1994/1996)
Longitude Mecca = 39º 50' (East Longitude)

b. Data processing and Coding
90º - (+ 00º 30') = 89º 30' (a)
90º - (+ 21º 25') = 68º 35' (b)
101º 28' - 39º 50' = 61º 38' (c)

c. Formula, $\frac{\cot b \times \sin a}{\sin c} : - \cos a \times \cot c$ (Susiknan Azhari: 2001)

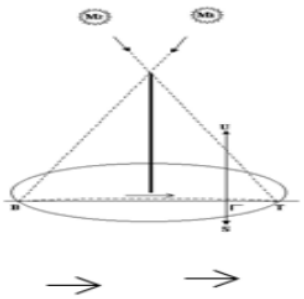
d. The solution
cot 68º 35' x sin 89º 30'
---------- : - cos 89º 30' x cot 61º 38'
sin 61º 38'
68 oo 35 " tan inv/shift 1/x
89 oo 30 " sin :
61 oo 38 " sin -
89 oo 30 " sin cos x
61 oo 38 " tan inv/shift 1/x = 0,44103533
inv/shift 1/x inv/shift tan inv/shift oo 66º 12' 2,97"

Qibla Direction in Pekanbaru is 66º 12' measured from the North point towards the West point (Qibla direction), or 90^0 - 66^0 12' = 23º 48' measured from the West point towards the North point (Qibla direction). Azimut Qibla city of Pekanbaru is 270º + 23^0 48' = 293º 48' measured

from the North point, through the East point, South point, West point and Qibla point.

The measurement of Qibla direction measurement in the field requires the following equipment;

1. Stick, designed by using the lot so that it is perpendicular.
2. Flat court, measured using a waterpass.
3. The court should be white and clean so that the stick's shadow can be seen clearly.



M^1 = The position of the Sun before noon. M^2 = The position of the Sun after noon. → shadow tip of the stick to B, the intersection point of the tip of the stick tip (West) is T and the point of intersection of the tip of the stick tip (East) = North and South.

New applications emerge of new problems in the field, for example building a mosque based on an existing mosque or guided by the Sunset, even in the direction to the West. Such practices are not the same as the results and can cause polemic in the community. Therefore the Fiqh method is controversial in determining the direction of Qibla, as well as in the Islamic Astronomy Scientific method. Islamic Astronomy Science uses a variety of methods from Classical to Modern . The classic method of determining the direction of the Qibla is based on the estimates of the Sunset, which changes the direction of the Qibla monthly . Modern reckoning methods use astronomical data with certain formulas, the results are considered more accurate. Therefore, the controversy regarding the direction of Qibla in Indonesia is due to the use of different methods

.

Historically the method of determining the direction of Qibla in Indonesia has been developing alongside the demands of scientific and technological progress and the development of Islamic intellectual life. The tools used to measure the direction of Qibla ,as well as the calculation system and the coordinates of Mecca and regional data continue to develop.

Accuracy of Qibla Direction Calculation

Changing the inaccurate direction of Qibla is not an easy and simple problem as illustrated by the example of the change of the direction of the Yogyakarta Kauman Mosque by KH. Ahmad Dahlan, (Karel A.Steenbrink: 1984), raising polemic and challenges to the community. According to KH. Ahmad Dahlan, the direction of Kauman mosque facing Ethiopia (West point) is changed to face the Ka'bah, which is facing West oblique to the sea and rather than the right West, determined by the reckoning method. The case of the Kauman mosque also occurred in various regions in Indonesia because most people still use traditional methods. There was an overreaction from the public who rejected the results of the modern reckoning which was considered accurate, because they did not yet understand the method of modern Islamic Astronomical Science and its measurement in the field, which they knew was only guided by the direction of the Sunset.

The above events clearly indicate that the problem of accuracy of Qibla direction becomes an important issue for Muslims (Hajar Hasan: 2014). Nash al-Qur'an and Hadith explain that the Qibla only provides a general understanding that causes space for differences amongst scholars in determining the direction of Qibla. After Indonesian Muslims recognise and master the Science of celestial sphere, the determination of the Qibla direction is guided by astronomical formulas and data. The results of the calculation of modern astronomy are considered far more accurate than the classical (traditional) and Fiqh methods.

After observing the Islamic Astronomy Science and Fiqh methods developed in the community, it is even used as the basis for determining the Qibla. The implementation is controversial . For example, following the Aceh Sunami earthquake, many mosques change the direction of the Qibla. The public argues that the earthquake changed the position of the direction of the Indonesian mosque . After careful observation of the case, we can say that it was not the earthquake that changed the direction of the Qibla, but the measurement of the initial construction of the mosque which was wrong because it was generally guided by the Sunset. This phenomenon is very worrying for Muslims throughout Indonesia because they have to change the direction of the mosque's qibla in various regions.

In-depth discussion can be conducted with modern reckoning methods which are considered to be more accurate than traditional reckoning and Fiqh methods conducted by Fiqh scholars. Modern reckoning uses Astronomical and Mathematical formulas and is supported by an accurate set of data while being equipped with several tools. An example of determining the direction of Qibla Pekanbaru includes the calculation being equipped with coordinate data 00º 30' North Latitude and 101º 28' East Longitude and formula *ctg b x sin a: sin c –cos a x ctg c*, the result 66º 12' measured from the point north to West and 23º 48' measured from West to

North. Therefore, the Pekanbaru Qibla azimuth 293º 48' towards the North from the West point 23º 48'.

The advantages of this method include the fact that it can be done at any time if the coordinates of Mecca and regional data and formulas and tools are available. The authors offer to use the method of Islamic Astronomical Science as a way of overcoming cases of measuring Qibla in the wrong direction throughout various regions in Indonesia, because it has undoubted accuracy , or to use the method of Sun shade across the Kaaba the method of measurement in the field is relatively easy. Houses of worship that are not in the proper direction of the Qibla can be corrected by measuring the Saf in the mosque and do not need to be dismantled.

Conclusion

Islamic Astronomical Science is an important Science and is seen as the oldest Scientific method of human life . It is directly related to Islamic law, especially worship. The existence of Islamic Astronomy and Jurisprudence cannot be separated from human life, especially Muslims, because both these Sciences become the basis and guidelines for implementing Islamic law. With this knowledge people can determine the correct and accurate direction of Qibla in various regions in Indonesia and throughout the world.

According to this study, determining the direction of the Qibla direction according to Fiqh was general and simple, and considered sufficient to face the 'Ainul Ka'bah for people who could see the Kaaba and for those who were far from the Kaaba and facing it only without setting its position and magnitude. The determination of the direction of Qiblabased on Islamic Astronomical Science is more accurate and detailed because it uses proven methods, formulas, data and tools. The validity of this method is recognised by astronomers as well as the Indonesian reckoning and rukyat body and can be completed at any time. The disadvantage is that not everyone can determine the direction of Qibla with the reckoning method.

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